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ABSTRACT

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Current Trends and Future Prospects for Archiving Scholarly Communication: The Case of Electronic Journals

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Abstract

The development of stand-alone, Web-based electronic journals began shortly after the Internet became widely accessible among researchers. These journals represented one of the first attempts to utilize the Internet as a forum for the regular distribution of peer-reviewed scholarly research. The purpose of this paper is to examine issues related to the preservation of online scholarly electronic journals. The paper begins by clarifying key concepts concerning digital preservation then moves into a general overview of the challenges faced by information providers in preserving and making accessible digital resources. This is followed by an outline of the unique characteristics of web-based electronic journals, including an analysis of issues related to editorial authority, accessibility, and the merit and promotion process. Current attempts to preserve electronic journals are discussed, followed by an analysis of future trends in the field of digital preservation and its relationship to the archiving and maintenance of online journals in the near and distant future. The paper concludes with recommendations intended to lay the groundwork for collaborative efforts to systematically preserve electronic journals on the Internet.

It was not long after the creation of the World Wide Web interface that scholars began to use the Internet as a forum for the regular distribution of interconnected scholarly research. In fact, this was one of the original uses of the Internet after the system had evolved from its origins as a distributed communications network to address the challenges of maintaining communications in the event of a nuclear war.¹ For those of us who remember sitting at our desks searching for information using awkward gopher systems, the World Wide Web has fundamentally revolutionized the way in which scholars communicate, exchange ideas, and create new communities of researchers absent the constraints of time and space.

In response, academic libraries have had to revolutionize the manner in which they acquire, classify, disseminate and store information. Some have even argued that the library itself will be rendered obsolete by the further development of digital resources.² There are numerous publications available that explore the impact that the Internet and other forms of information technology have had on libraries and the practice of librarianship, so I shall refrain from repeating it here.³ Suffice it to say that the information technology landscape is one of constant change and perhaps the most difficult challenge facing libraries and other information providers in the future is to adapt rapidly to these changes while, at the same time, remaining connected to the needs of researchers.

One of the more vexing challenges facing libraries today is archiving and preserving digital resources. This process is expensive and it requires the same commitment of time and resources to evaluate, select, and manage as it does to preserve traditional materials. However, electronic resources present particular challenges that resist easy solutions or inexpensive options for stakeholders. The purpose of this paper is to provide an overview concerning the archiving of digital information used and often created by academic researchers. The paper begins by defining key terms and placing the archiving of digital information in the larger context of current trends in knowledge creation and use of the Internet as a delivery system. The paper then focuses this analysis to consider the unique challenges of web-based electronic journals. These are journals that are solely created for distribution on the Internet, as opposed to electronic equivalents or the retrospective conversion of print journals in PDF format. Finally, I discuss what is being done now to preserve electronic journals and offer some recommendations for librarians and journal editors to consider when examining the issue of preserving the knowledge produced in electronic journals for future scholars.

Clarifying Key Concepts

The concepts of archiving and preserving are often used interchangeably in the literature of education research. Michael Day argues that there is a subtle, yet clear difference between the two terms. He states that the term archiving is often used by computer scientists "to mean the creation of a secure backup copy for a fixed period of time," while the term preservation refers to the survival of information over time.⁴ It is the latter concepts that is used throughout this paper.

There is also some ambiguity among educators concerning the issue of how long to store information and in what form. The most common assumption is that archiving information implies perpetuity. However, this is both impractical and very often undesirable. Within the community of most librarians and archivists, the objective of preservation is more pragmatic. Archiving means that information remains in an accessible format for as long as it is needed (as defined by the researcher)⁵ or that materials should be retained for only a period of time in which there is value in committing the proper space and resources to do so.⁶ Again, the latter definition is the primary focus of this paper.

Another potential area of confusion is the distinction between the process of digitalization for preservation and the archiving of digital resources. The first concept refers to the application of information technology for the purpose of preserving print or other non-electronic materials in an alternative digital format to facilitate accessibility. An example of this practice is Project MUSE at Johns Hopkins University. Project MUSE is a cooperative initiative between Johns Hopkins University Press and the University library to provide online access to scholarly journals in a variety of social sciences and humanities disciplines.⁷ An institutional subscription includes a compact disk containing all of the articles published online during the previous year. In this way, libraries own the material from the electronic files to which they subscribe and the compact disk can be considered an archival copy of the articles. However, Project MUSE only digitizes journals which have been printed in paper and does not currently focus on web-based electronic journals.

The archiving of digital formats encompasses just that—the activities and procedures associated with identifying, evaluating, and preserving information that is either stored in an electronic device, such as a computer disk, or delivered exclusively over networked online systems such as the Internet. This is an important concept to remember when examining the issue of

archiving electronic journals. Their preservation implies not just the content of the journal, but preserving and maintaining the information carrier itself. Accessibility depends on peripheral devices that store the information in machine readable form so researchers can make subsequent use of it over time.⁸

A final concept used in this paper that may require clarification is electronic scholarly information in the form of a journal. This refers to peer-reviewed serial publications issued exclusively in an electronic format and made available over the Internet. As with traditional journals, it is distributed in successive parts and usually includes numeric and/or chronological designations. However, the publication is often supplemented with hyperlinks to other information on the Web and may include audio or visual augmentations.

Contextualizing Current Trends in Digital Preservation

There are several challenges unique to electronic formats that are directly related to issues of technology, the law, and organizational structures and management policies. What follows is a brief outline of each of these issues and a discussion of how libraries and publishers are addressing them. The technology is evolving so rapidly that only trends and possibilities can be discerned at this point in time, although this has not prevented a cornucopia of speculative literature to be born out of an anxiety about our digital future. Currently, the overriding trend is to force today's square traditions to fit the round hole of emerging technologies. Regardless of this dubious strategy of adaption, two certainties are likely to continue into the near future: 1) as stated before, changes are constant and highly unpredictable, and 2) emerging technologies in the future will likely offer the best opportunity for solving many of the challenges that I am about to describe.

Technology Issues

First, digital resources do not stand apart from their delivery system. The information stored on a computer disk or at an Internet site is inaccessible without the proper hardware and software to deliver and decode that data. This was never a problem with printed information. There was never an intermediary device between the researcher and the information. The advent of microfiche and film required a reader/printer and, of course, a copy machine was required to make copies of what you were investigating if one needed to do so, but in general print could stand alone in perpetual

storage. Beginning with computer files, compact disks, and now information stored on the Internet, digital resources requires an intermediary device in order to decode and display information. Archivists are now faced with not only storing the information but the axillary devices as well.

Second, technological advances in information technology move at a tremendous pace, both with regards to new and improved software programs and in terms of faster and more complex delivery systems. In contrast, the printed page has remained essentially unchanged for centuries and librarians, in turn, have treated the archiving of print materials based on a set of procedures based on well-established standards and rules that have paralleled the history of the printed page. The unique challenges of preserving digital information has forced librarians to reconceptualize these procedures and created the need for revise standards of practice. Unlike centuries ago, these standards cannot be developed in isolation, but are dictated by the rules and regulations of other groups, such as technologists, who do not necessarily share the same values and belief systems concerning service and access.

A third unique challenge to preserving digital resources is the lack of expertise in preserving this type of format. Lacking this expertise within their own field, librarians have, until only recently, found themselves relying on external constituents to create systems and procedures for storing electronic information—a system of dependency that often does not parallel the tenets of open access and the building of diverse collections embraced by the library profession. Systems created by computer programmers often exhibit creative solutions to very difficult technical problems, but do not always consider the subtleties of how the user interacts with the computer when searching for information, especially in an academic environment. In addition, publishers and other information providers are motivated primarily by profits, therefore, the storage of information often has little to do with user need or a commitment to service and open access. Due to the fact that almost all endeavors to preserve electronic information is expensive, publishers have been hesitant to take the initiative, leaving the digital landscape pocketed with inconsistent archives of older materials that do not always reflect the needs of the academic community.

Legal Issues

A fundamental shift has occurred in the relationship between the publisher and the library. Traditional print journals are purchased through institutional subscriptions that, under existing copyright laws, provide fairly well-defined parameters for how the content of the journal is used, distributed, and stored over time by the subscribing institution. In other words, the payment of a subscription infers ownership over the physical object. Copyright laws define the "fair use" of the journal's content, but the library retains the right to sell, redistribute, or discard the object at any point in time after the journal has been purchased and it has been determined that the publication is no longer of value to researchers.

Congress has been slow in addressing the need to revise our nation's copyright laws in response to the unique characteristics of the digital age. Oberson argues that publishers and vendors have taken commercial advantage of these ambiguities by applying contract law rather than copyright law to the distribution of online journals. Publishers license specific rights of use over a journal or set of journals for a limited period of time that may or may not parallel the traditional annual subscription period. Because there is no physical object, the terms of licensing agreements may exclude libraries from allowing researchers to copy, distribute, or otherwise use the journal. In addition, publishers may impose a "pay-per-use" limitation on individual articles. In this way, the subscription may not pay for the entire journal issue or in perpetuity, but for a set number of "views" by the researcher that, once reached, requires the institution to renew access to the journal's content.⁹

In response, libraries have adopted several strategies. First, they have formed consortiums intended to force publishers to be more responsive to researcher needs by applying the collective authority of groups of institutions. Second, libraries have sought joint ventures with publishers to establish shared initiatives that are beneficial to both the library's interests and those of commercial publishers. And finally, the Copyright Clearance Center represents another approach to resist contract-based licensing agreements. Currently however, the Center has not considered including digital resources because of uncertainty regarding how to grant limited rights to digital copying, how to track usage, and how to ascertain the appropriate amount to charge for access and whether this access includes only printed copies or other forms of redistribution.¹⁰

The passage of the Digital Millennium Copyright Act in 1998 offers some hope that

legislators will begin to take seriously the problem of copyright in a digital environment, but there remains a concern among library leaders that copyright holders will develop technology for continuous control of access to materials, thereby undermining the concept of fair use. In addition, there is concern that the law does not adequately address the issue of whether certain classes of copyrighted works should be exempt from the law's anti-circumvention provision. This provision prohibits overriding technological controls intended to limit access to a copyrighted work, such as using encryption technology to prevent copying of DVDs.¹¹ Despite these remaining challenges, the Act is the first substantial attempt to address the legal issues surrounding the digitalization of information. However, until the Act is tested in the courts, it offers little other than a general framework of understanding to guide libraries in defining access and use with publishers of electronic journals.

Organizational and Managerial Issues

Another dimension to preserving digital resources concerns organizational and managerial issues. Reallocating limited resources for the long-term preservation and maintenance of digital information requires a serious commitment to reorganizing how decisions are made about what should be preserved and why. Perhaps the most fundamental change that must take place within the organization is to resist the idea that everything should be archived. Just as with traditional resources, the evaluation of what materials should be archived must be considered within the context of the overall mission of the institution, curricular and pedagogical need, and the material's relationship to both current and future research initiatives.

On a broader level, organizations have been forced to straddle a balance between a commitment to service that incorporates both traditional, print-based resources and digitalized products. In theory, this commitment should provide access to information regardless of format, but in practice, libraries are continuing to see a stronger emphasis placed on technology due, at least in part, to the changing dynamics of searching for information by researchers, but also due to factors related to misguided perceptions that everything is on the Internet. Given this, the changes brought about by emerging technologies are both complex and multifaceted.

On a fundamental level, the re-allocation of resources to preserve digital resources must include the availability of workstations with sophisticated navigation tools to view network-based

information. The hidden challenge here is that the cost to upgrade and maintain this equipment often far exceeds the initial cost of purchase. In addition, maintenance of the equipment requires expertise normally not found within the library requiring that the library must rely on external service providers that may not exhibit the same commitment to service that is central to the normative rules governing the practice of librarianship. The retrieval systems that link the researcher's query to the resource must be developed in such a way that they are easily integrated with current search protocols in online catalogs and other databases. These integrated systems are essential in providing guideposts to building pathways to related information that is otherwise ordered chaotically in the Internet environment.

Donald Waters argues that the most appropriate design for organizations to follow when meeting the challenge of determining what to preserve and the reasons for doing so is to create organizations that systematically and deliberately engage researchers in the decision-making process. According to Waters,

We need to measure the appropriateness of those emerging digital-based services by their ability to facilitate these kinds of strategies. Periodically, we then need to confirm that teaching and research in a digital environment still depends on the strategies transferred from an analog or paper-based environment, and we must monitor, adjust to, and incorporate the transformed means of scholarly communication that will almost certainly develop and that will be especially adapted to forms of digital information.¹²

Waters model calls for a long-term commitment to collaboration among key constituents in the academic community in order to determine the best procedures for digital preservation. These constituents include library faculty, teaching and research faculty, technologists, and administrators who must work collectively to transform traditional practices for accommodating emerging technologies.

Electronic Journal Preservation Issues

In the previous section, I have attempted to provide a contextual framework for understanding the issues surrounding the digital preservation of scholarly communication. In this section, I focus the discussion on issues specific to electronic, Web-based journals. The emergence

of electronic journals has grown significantly over the past several years. For example, Marti Hearst used data from The Information Economy web site produced at the University of California at Berkeley to show that from 1994 to 1997 there was a proliferation of 181 titles to almost 1,100.¹³ The latest edition (1997) of *Directory of Electronic Journals, Newsletters and Academic Discussion Lists* published by the Association of Research Libraries lists almost 1,700 titles of various online serial publications, although certainly in both cases not all of the items listed were scholarly in nature.¹⁴ Several factors are affecting the ability of institutions to commit the resources needed to systematically archive electronic journals.

Editorial authority

The first issue concerns the transfer of editorial authority from one institution to another. In the print environment, the changes to the editorial board or even from one publisher to another rarely affected the distribution or format of the journal. In fact, some would argue that the transfer of editorial responsibility is healthy for the profession because it prevents journals from aligning too rigidly to only one set of perspectives. Unfortunately, the transfer of journal ownership from one publisher to another often leads to an increase in the subscription rate as the publishing world becomes smaller and begins to more closely resemble a shared monopoly. In addition, transfer of authority or publication rights rarely leads to any concerns that the print-based journal will cease publication. Most often, changes are peripheral, such as a change in frequency (i.e., biannual to quarterly) or format. Coupled with the fact that some title runs extend back several hundred years, "behind the scenes" changes to a journal title have little affect on accessibility. This stability facilitates easy preservation and justifies setting aside the space to store the journal.

The transfer of editorial authority is less certain with web-based electronic journals. Often these journals are created by technologically gifted faculty members who have committed the time and resources to ensure that the journal survives. It is difficult to find any data to suggest otherwise, but one would assume that when this driving force is no longer behind the journal's production, the long-term survival of the publication can be placed in doubt. Since most networked electronic journals tend to be non-commercial in nature, they do not have the added support of a publication company that can help maintain sales.

Perhaps most critical is the fact that the electronic journal cannot exist without the technological support of the institution in which it resides. Web-editing, distribution, and linkages to other information on the Web requires network support and often technical assistance. This type of support must be maintained when the journal's production shifts from one institution to another and require prior agreements of server access and technical support before a transfer could occur. This problem is particularly challenging if the home institution's library takes the initiative in archiving the electronic journal. The same level of transfer agreements would have to be negotiated between preservation organizations.

The lack of indexing

With very few exceptions, especially with regards to electronic journals produced outside of the science disciplines, major indexing services have failed to index web-based, peer-reviewed journals. Multidisciplinary online indexing and abstracting services, such as OCLC's Firstsearch system, Proquest, and InfoTrac, provide access to the contents of thousands of journal titles. Often searchable using sophisticated Boolean operators and organized with standardized subject-headings and thesaurus terms, these indexing services are one of the essential tools used by researchers to find information. Most of these indexing services are continuations of earlier print indexes.

This is not to imply that indexing electronic journals for publishers of indexing services is simply a matter of committing the time and resources. For example, citations to an electronic journal differ from those of traditional serials. Electronic journals have retrieval methods, server addresses, file sizes, article addresses, and archive sites that must be included with the normal bibliographic information (author, title, journal title, pages, etc.) to make the journal content accessible to the researcher. Some journals do not include paging information which requires alternative descriptors designed to give information about the size of the article, such as number of lines or bytes of information. A more serious problem with indexing electronic journals is inconsistent delivery to subscribers. Most libraries maintain established procedures for ordering a missing issue from publishers. However, these procedures are not self-evident with electronic journals because often the absence of a journal issue was due to server addresses changing. When this happens, indexing editors must search the Web to find the new URL address or wait for a possible e-mail notification of changes to the server location.¹⁵

Tenure and promotion recognition

There can be several advantages to publishing new research in electronic journals. For example, the technology facilitates rapid distribution of findings and is not burdened by the normal constraints affecting the publication schedules of traditional print journals. The content can be supplemented with various multimedia, such as audio or visual effects. The text can be imbedded with links to other sources on the Internet. Electronic distribution offers new opportunities for broadening and sharing research results across disciplinary boundaries. And perhaps most important, electronic journals offer the chance for scholars to take back a measure of control over some of their intellectual work from those publishers that charge exorbitant subscription prices, ultimately limiting the distribution of new knowledge to only those who can afford it. Despite these opportunities and enhancements, academe has been slow to accept electronic journals as a legitimate form of scholarly communication in the merit and promotion process. Setting aside localized resistance rooted in the unique culture of a particular institution and acknowledging the fact that resistance is not uniform across disciplines, there are several perceptual barriers that appear to help undermine the broad acceptance of electronic, Web-based journals as a legitimate scholarly publication source.

First, there is the issue of peer-review. Some have questioned the validity and level of rigor associated with peer review on the Internet.¹⁶ A common alternative practiced on the Internet is to include comments from reviewers along with the article, undermining the concept of publishing only original research after a review process. Interestingly, when the *Journal of American History* included reviewer comments with a particularly controversial article published by a well-known and well-respected historian, most letters to the editor viewed this as a refreshing and insightful exercise in revealing the mysteries surrounding scholarly peer-review and publishing.¹⁷ The critical challenge, therefore, appears to center around the issue of control over the flow of information and the need to strike a balance between allowing broad distribution of ideas among a variety of scholars and the need to maintain the quality and integrity of research within the field of study. To some who wield academic power in promotion decisions, this balance is always in jeopardy because of the perceived chaos of the Internet.¹⁸

Second, most electronic journals are not indexed and, therefore, citations to articles are hard to come by, especially when reviewing the references of authors who have published articles in well-

established, traditional journals. In other words, very rarely are the leaders of a discipline found to cite electronic journals in their research. This is a problem because many merit and promotion procedures use citation indexes to gage both the value of the journal (based on a variety of factors such who is on the editorial board, how long has the journal been published and by which publisher, the manuscript acceptance to rejection ratio, etc.) in which an individual has published as well as the number of times a person's work has been subsequently cited by other scholars. This renders publishing a research paper in an electronic journal risky for the non-tenured professor facing the tenure clock. Even if the journal is relatively well-known in the field and the editorial board is strong, the lack of indexing in comprehensive online databases or the standard print indexes of the discipline can be a significant hindrance to recognizing the validity of the research if academic powers rely heavily on citations to determine an individual's academic publishing accomplishments.

A third challenge concerns the challenge of breaking down the traditional rules of achieving tenure in the university. At the center of this issue is a bureaucracy that is often resistant to change. Redefining the promotion and tenure procedures is not simply a matter of enacting policy, but likely involves an arduous journey of negotiation among faculty and between faculty and university administrators. Official documents such as a faculty handbook must be rewritten and new internal procedures must be created and tested. In many institutions, changes to the tenure and promotion process as defined in the faculty governance means traversing a potential political minefield and few would risk taking the first steps towards reform.

What This Means for Preservation

All these factors—the perceived ambiguity concerning editorial control and peer-review in a digital environment, the absence of electronic journals in most indexing services, and the distributive politics of changing promotion procedures—have a negative impact on the ability of libraries and computing services organizations to commit the resources needed to preserve electronic journals in a systematic manner. Archiving materials, regardless of format, requires an institution-wide commitment to address the costs of creating and delivering digital archives¹⁹ as well as the resources, such as space (in the case of digital archiving this may translate into network server space and related technology), technical expertise, and the redistribution of public services to accommodate inquiries about digital resources.²⁰ This is not to say that little or nothing is being

done to address the need to preserve scholarly communication delivered in the form of an exclusively Web-based electronic journal. In the next section, I briefly outline some current efforts to make online journals more accessible and to highlight possible approaches to accessing and preserving electronic journals.

What is Being Done and the Challenges that Remain

A number of initiatives currently exist that are focused on the preservation and long-term storage of digital resources, including electronic journals. However, many of these efforts act more as a digital distribution center rather than a comprehensive focal point on the Internet for preserving scholarly communication in the form of web-based electronic journals. For example, the New Journal and Newsletter Announcement List ("NewJour") web site is intended only as a clearinghouse for announcements made concerning the launching of a new electronic journal or a digital setting for announcing the availability of paper journals and newsletters as they become available on the web. However, James Jacobs of the University of California (San Diego) library does maintain searchable backfiles from the NewJour site.²¹

Another example of the archive/clearinghouse model is the site maintained by the Colorado Alliance of Research Libraries Electronic Journal Access site. The main purpose of this service is to provide access to electronic journals either from a comprehensive alphabetical list by title or arranged using Library of Congress subject headings. No attempt has been made to evaluate the content or quality of the journals, but each title is accompanied by a brief description of the journal's scope and purpose. As with the NewJour project, no attempt has been made to actually archive the contents of the journals indexed. New titles are added "as they are discovered" and links are checked periodically for accuracy.²²

Perhaps the best illustration of attempts to make electronic journals secure and available is the experience of those involved with the development of an electronic archive for the journal *Physical Review Online*. Named PROLA (Physical Review Online Archive), this project is sponsored by The American Physical Society and currently contains a nearly complete electronic copy of *Physical Review* from 1985 through 1996. As the developers note, the challenge to relying on libraries to archive the journal is the loss of control libraries have over the journal itself as it

moves to a digital environment. In other words, if the journal is available online, the library's traditional involvement in archiving is no longer necessary and the burden to preserve scholarly communication falls to the publisher. From the perspective of the publisher there were several challenges—the financial burden required to develop an archive, the source of income from such a project, and the cost of maintaining hardware as emerging technology was developed. In addition, costs for human resources was difficult to measure and, in fact, this factor was underestimated when the project began because the archive was much more dynamic than anticipated.²³

Among the lessons learned from the experiences of those associated with the archiving of the *Physical Review Online* journal was that there were a number of unanticipated and hidden complexities related to creating the archive, such as, the need for a substantial commitment of human resources to maintain the content; the process of archiving required a broad commitment of a number of constituents who had to work in a coordinated fashion to ensure the overall success of the project; and the recognition soon after the project began that there was simply no immediate answers to some questions and that there had to be an acceptance of a system of trial and error before the archive was fully functional.

Recommendations for Consideration

The preservation of electronic journals involves addressing a complex set of interrelated challenges. These challenges are the result of several factors—the unique design of digital preservation, the growth of information technology and the pace of technological advancements, the ambiguous relationship between editors, publishers, and academic libraries in archiving scholarly research, and institutional traditions that are resistant to change in tertiary education. Below are four recommendations intended for electronic journal editors, publishers, and libraries to consider. These observations are based on a review of the current literature and personal observations of how the University of Southern California is grappling with the proliferation of web-based electronic journals. These recommendations are intended to lay the groundwork for systematic, comprehensive, and authentic preservation of scholarly communication in the form of web-based journals.

1. *Editorial boards should articulate a statement of purpose for preserving electronic journals.*
The purpose of a preservation statement is two-fold. First, it informs the reader that the journal publisher intends to preserve the scholarly integrity of the content for future use and describes the ways in which this will be accomplished. The statement could include, for example, information about where to go to find earlier issues online, the manner in which the journal is preserved (i.e., as PDF files, in HTML, etc.), the maintenance of redundant sites where copies of the journal are located, and provisions for transferring editorial responsibility to ensure the viability of the journal should it be relocated to another institution. The second purpose of recommending that a statement of purpose regarding preservation be formulated is that the exercise would force stakeholders invested in the long-term viability of the journal to think critically about developing a plan of action for the preservation of scholarly communication in the form of a web-based journal.
2. *Libraries should be reorganized to ensure preservation of electronic journals created at their institutions.*

The burden of preservation should not be entrusted entirely to commercial publishers that must at adhere to the motivation for profit-making in order to survive in a competitive marketplace. The burden also should not be laid entirely at the feet of those who create and maintain web-based journals. Libraries located at the institution in which the journal is published online should be proactive in working collaboratively with electronic journal editors to develop a preservation plan and the technical support needed for long-term storage. If the journal is produced by a professional organization, then the organizational leaders associated with the production of that journal should solicit help from a library or group of libraries willing to work with the organization to invest the time, money and resources needed to preserve the journal.

3. *Electronic journal producers and academic libraries should seek consortial opportunities to archive digital information.*

One of the recommendations commonly found in the professional library literature devoted to examining ways for ensuring the long-term access to digital information sources is to establish standards for supporting redundant electronic locations.²⁴ This process is much easier to accomplish in an environment of consortial agreements among universities and libraries. Journal editors and librarians at multiple institutions can work cooperatively, as well as share responsibility and

resources, for developing policies and procedures in support of constructing a distributed network of digital repositories for preserving electronic journals. A collective commitment to maintaining a centralized archival repository is also an opportunity to share in the promotion of the journals and to exchange ideas concerning how best to solve the problems of digital archiving.

4. *All stakeholders should encourage emancipatory initiatives that take back control over the intellectual endeavors of scholars.*

Web-based electronic journals offer an opportunity to pursue alternative avenues for publishing scholarly information. The rising costs of print journals, especially in the applied and theoretical sciences, has strained academic library budgets to an extent that many libraries cannot keep up. For example, at the University of Southern California librarians have been unable to purchase any new journal titles in print since 1995 unless another journal ceases publication or is cancelled. Although the issues of reconfiguring merit and promotion criteria and adequately preparing for the hidden costs of developing, maintaining, and preserving web-based electronic journals remain a challenge, this should not prevent researchers from joining the movement to take back a measure of control over our scholarly endeavors, especially with regards to those commercial publishers that continue to charge exorbitant prices to institutions for their journals.²⁵ Web-based electronic journals could provide an alternative forum for the dissemination of research, but professional societies, researchers, and libraries must work together in overcoming current barriers to fulfilling this promise.

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